

Sodium Bicarbonate Ingestion for Performance Enhancement in Cycling: From Original Concept to Endurance Ergogenic

Andy Sparks^{1,2,*}

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¹ Research Innovations Manager, Maurten AB, Gothenburg, Sweden.

² Honorary Visiting Research Fellow, Research Institute for Sport and Exercise Science, Liverpool John Moores University, Liverpool, UK.

Correspondence

Andy Sparks

Research Innovations Manager, Maurten AB, Gothenburg, Sweden.

Andy.Sparks@maurten.com

Abstract

Ingestion of sodium bicarbonate (SB) to enhance extracellular buffering and exercise performance has been researched since the 1930's. In that time there has been a considerable volume of research on SB across many sport and exercise contexts. Much of this work was conducted during the 1980's and 1990's (McNaughton, 1992) and laid the foundations for the ingestion practices that some athletes are still using, but over the past 10 years, there have been notable advances in SB ingestion methods. Renewed interest in SB began with the identification of highly variable inter-individual blood bicarbonate (HCO_3^-) responses (Jones et al., 2016), typical with traditional ingestion modes such as fluid or gelatine capsules. In response to this, the time to peak pre-exercise ingestion timing approach demonstrated that individualising ingestion time could improve performance further (Boegman et al., 2020). Meanwhile, attention also started to focus on methods to reduce the gastrointestinal symptoms (GIS) that can negatively impact performance for some athletes following SB ingestion. Pharmaceutical technologies were used to reduce the interaction of SB with stomach acid, via delayed release and enterically coated capsules, establishing that it was possible to considerably reduce some of the GIS (Hilton et al., 2019). In so doing, the pharmacokinetic responses of blood HCO_3^- were also observed to be specific to the mode of SB ingestion, which has implications for both the dose and timing of each ingestion form to maximise its ergogenic potential (Leach et al., 2023). The resolution of GIS problems has come recently in the format of a commercially available SB ingestion system that combines mini-tablets with a carbohydrate hydrogel delivery system (MBS). The MBS has demonstrated very low GIS responses and elevated and prolonged changes in blood HCO_3^- (Gough and Sparks 2024a). Furthermore, the MBS has now been shown to be effective at improving performance and recovery from 4 km time trials (Gough and Sparks 2024b), to enhance 40 km time trial performance (Shannon et al., 2024) and is being used extensively in the professional peloton. Interestingly, Shannon et al., (2024) have also suggested that gross economy may be improved using the MBS, along with relative reductions in perceived exertion. With the resolution of the GIS, it may now be possible to more clearly determine the ergogenic mechanisms that SB may enhance in addition to hydrogen ion buffering. These potential mechanisms include improved economy, muscle recruitment, and reduced pain and perceived exertion, and represent an exciting new avenue of investigation in future SB performance research.

Keywords: extracellular buffer; ergogenic aid; high-intensity exercise; endurance exercise; supplement



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